

National Bureau of Standards REFINEMENT OF VALUES FOR THE YARD AND THE POUND

Background. The National Bureau of Standards, founded in 1901, is authorized by statute (U.S. Code, Title 15, Ch. 7, sec. 272) to undertake "The custody, maintenance, and development of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards. * * * Under this authority the National Bureau of Standards has sought to refine and extend the standards to meet the continuing requirements of science and industry for increased accuracy and uniformity of measurement.

Since 1893 the National Bureau of Standards and its predecessor agency, the Office of Standard Weights and Measures of the Treasury Department, have derived the yard and the pound and the multiples and submultiples of these units from metric standards, namely, the international meter and the international kilogram. The original announcement of this derivation, together with the numerical ratios upon which the derivations were based, is given in Bulletin 26, "Fundamental Standards of Length and Mass", of the U.S. Coast and Geodetic Survey, approved for publication April 5, 1893, by the Secretary of the Treasury. An amendment to the 1893 Bulletin was made in 1894 in which there was a small adjustment in the pound-kilogram ratio to bring it into closer agreement with the British Imperial pound.

In the latter half of the period since 1893 minor but troublesome discrepancies have developed among various groups, both in this country and abroad, that are concerned with very accurate measurements involving yard and pound units or their customary multiples and submultiples. As a result of study and negotiation, it has developed that most of the discrepancies can be resolved and a high degree of measurement uniformity obtained by small refinements of the ratios defined in the 1893-94 bulletins relating the yard and pound to the meter and kilogram. Accordingly, the following announcement is made:

Announcement. Effective July 1, 1959, all calibrations in the U.S. customary system of weights and measures carried out by the National Bureau of Standards will continue to be based upon metric measurement standards and, except those for the U.S. Coast and Geodetic Survey as noted below, will be made in terms of the following exact equivalents and appropriate multiples and submultiples:

$$1 \text{ yard} = 0.9144 \text{ meter}$$

$$1 \text{ pound (avoirdupois)} = 0.45359237 \text{ kilogram}$$

Currently, the units defined by these same equivalents, which have been designated as the International Yard and the International Pound, respectively, will be used by the National Standards Laboratories of Australia, Canada, New Zealand, South Africa, and United Kingdom; thus there will be brought about international accord on the yard and pound

by the English-speaking nations of the world, in precise measurements involving these basic units.

Any data expressed in feet derived from and published as a result of geodetic surveys within the United States will continue to bear the following relationship as defined in 1893:

$$1 \text{ foot} = \frac{1200}{3937} \text{ meter}$$

The foot unit defined by this equation shall be referred to as the U.S. Survey Foot and it shall continue to be used, for the purpose given herein, until such a time as it becomes desirable and expedient to readjust the basic geodetic survey networks in the United States, after which the ratio of a yard, equal to 0.9144 meter, shall apply.

RELATION TO PREVIOUSLY DEFINED STANDARDS

In 1866 (U.S. Code 1952 Ed., Title 15, Ch. 6, secs. 204 and 205) the Congress legalized the use of the metric system within the United States. The law also established approximate equivalents between customary and metric measures. The above ratios between the yard and pound and metric measures as well as those defined in the 1893-94 bulletins are consistent with the ratios established by Congress in 1866 within the limits of accuracy by which the latter are expressed.

Yard. In the 1893 Bulletin the yard was defined as:

$$1 \text{ yard} = \frac{3600}{3937} \text{ meter}$$

which results in the approximate relation:

$$1 \text{ yard} = 0.91440183 \text{ meter}$$

Thus the new value for the yard is smaller by 2 parts in one million than the 1893 yard. Numerical measures expressed in terms of the new unit will, therefore, be increased by 2 parts in one million.

Pound. The pound was defined in the 1893 Bulletin as:

$$1 \text{ pound (avoirdupois)} = \frac{1}{2.20462} \text{ kilogram}$$

The 1894 amendment, based on a recent determination of the British Imperial pound, gave the ratio as:

$$1 \text{ pound (avoirdupois)} = \frac{1}{2.20462234} \text{ kilogram}$$

which results in the approximate relation:

$$1 \text{ pound (avoirdupois)} = 0.4535924277 \text{ kilogram}$$

Thus the new value for the pound is smaller by about 1 part in 10 million than the 1894 pound. Numerical measures expressed in terms of the new unit will, therefore, be increased by about 1 part in ten million.

Changes concern science and precision tools. Such small changes are beyond the limits of accuracy by which many reference standards are now calibrated by the National Bureau of Standards, including the standards furnished to or calibrated for the State governments. Therefore, the refinements in the defini-

tions of the yard and the pound will have no effect at all upon ordinary trade and commerce. The differences are significant, however, in a number of very precise metrological determinations such as are found in the precision machine tool and instrument industries and in certain scientific activities.

Standard inch. The value for the inch, derived from the value for the yard effective July 1, 1959, is exactly equivalent to 25.4 millimeters. It may be noted that this value was approved by the American Standards Association for "Inch-millimeter Conversion for Industrial Use" in 1933 (ASA Standard B48.1-1933), was adopted by the National Advisory Committee for Aeronautics in 1952, and has been adopted by many standardizing organizations in other countries.

Relation to grain. The new conversion factor for the pound is exactly divisible by 7 and results in the following exact value for the grain:

$$1 \text{ grain} = 0.06479891 \text{ gram}$$

The grain is the common unit of the avoirdupois, apothecary, and troy systems, there being 7000 grains in the avoirdupois pound and 5760 grains in the apothecary pound and in the troy pound.

Nautical mile. On July 1, 1954, it was announced that the Secretary of Commerce and the Secretary of Defense had agreed officially that the International Nautical Mile would henceforth be used within their respective departments. The International Nautical Mile is based on the meter and is equal to 1852 meters. Based on the yard-meter relationship then in use, the International Nautical Mile was shown as being equivalent to 6,076.10333 feet. Under the new conversion factor, the International Nautical Mile is equivalent to 6,076.11549 International feet approximately.

(For a detailed treatment of the Federal basis for weights and measures, see National Bureau of Standards Circular 593, The Federal Basis for Weights and Measures, for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., price 30 cents.)

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Approved: June 25, 1959.

F. H. MUELLER,
Under Secretary of Commerce.

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Office of the Secretary
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Statement of Changes in Financial Interests

In accordance with the requirements of section 710(b)(6) of the Defense Production Act of 1950, as amended, and